XXVI.—*On* Photodilus badius, *with Remarks on its Systematic Position.* By Frank E. Beddard, M.A., F.R.S.E., F.Z.S., Prosector to the Zoological Society of London.

The close association of *Photodilus* and *Strix,* which until recently was very generally held by ornithologists, is probably largely due to Nitzsch's researches into their pterylography[*]. So very similarly were these Owls found to be organized in this particular that Nitzsch declined even to separate them generically; they were accordingly referred by him to his genus *Hybris.* Before Nitzsch, however, *Photodilus* had been judged, on the evidence afforded by its external characters, to be closely allied to *Strix.*

External Characters (*Pterylosis, Oil-gland, &c.*).

The *pterylosis* of *Photodilus* has been described by Nitzsch, who, as already mentioned, was influenced by the arrangement of the feather-tracts to associate *Photodilus* and *Strix* together.

I am not quite clear whether Nitzsch really describes the pterylosis of *Photodilus,* or whether his remarks under *Hybris* are only meant to refer to the Barn Owl; that the latter supposition is true appears to be the opinion of Professor Newton. On the other hand, I do not find any distinct statement that the account of the pterylosis of *Hybris* is meant to refer only to the genus *Strix* as we now understand it; if that were so, then Nitzsch's grounds for uniting *Strix* and *Photodilus* would be rather slender.

The *pterylosis* of *Hybris* is stated by Nitzsch to be remarkable for the fact that the two branches of each pectoral tract join again behind the sternum; this was not at all clearly the case in my specimen of *Photodilus,* but until I have had an opportunity of examining *Strix* I reserve my further remarks upon the value of pterylosis in the classification of the Owls.

The *oil-gland* of *Hybris* is said by Nitzsch to have two minute feathers upon the apex, which cannot be accidental, as they were constantly found. Nitzsch does not say particularly whether he found these feathers in *Photodilus*; I did not myself succeed in finding them, though I made a careful search. This is a point of difference worth noting between the two genera, and it will be observed that in this respect *Photodilus* differs from *Strix* and agrees with other Owls.

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[*] Pterylography, Engl. ed. p. 70.

The *rectrices* are 12, the *remiges* 21 in number.

Mr. Sharpe has observed another character which distinguishes *Photodilus* from *Strix* *, and allies it with the Bubonine Owls (*Syrnium*, &c.); and I can quite confirm his statement, from an examination of my specimen, that the serration of the middle toe, which is to be found in *Strix*, is absent in *Photodilus*. The claw is, however, produced laterally into a knife-edge, as in other Owls.

External characters are therefore rather against the close association of *Photodilus* and *Strix*. Nevertheless, Dr. Coues, in his work on North-American Birds †, still retains the older view; he associates together *Photodilus* and *Strix* (called *Aluco*), mainly on account of external characters (*not* pterylosis), but also on account of the anchylosis of the furcula with the sternum ‡. He particularly mentions that in both genera "the inner edge of middle claw is serrate or jagged, simulating the pectination seen in Caprimulgidæ, to which birds these Owls are curiously related through *Steatornis*." In the paper just mentioned above, Mr. Sharpe pointed out that *Heliodilus* and *not Photodilus* is the genus which in this particular is akin to *Strix*. I have examined an example of *Strix* in which the jagged edge of the toe in question was very inconspicuous, and the question arises whether it does not occasionally disappear altogether.

OSTEOLOGY.

Skull.—The skull (fig. 1, p. 295) is less completely Bubonine than I had at first thought it.

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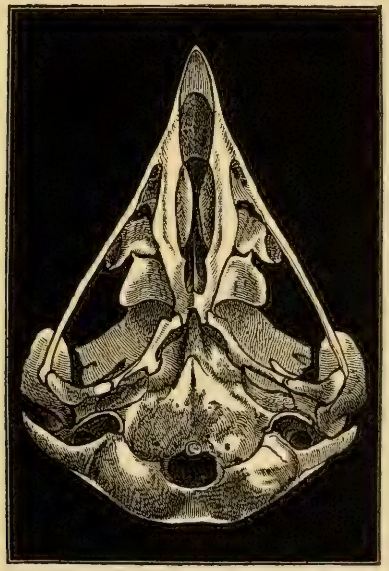
* A note on *Heliodilus soumagnii*, Grandidier, P. Z. S. 1879, p. 175.

† 'Key to North-American Birds,' 2nd ed. 1884, p. 500.

‡ There is not really this anchylosis; but an appearance of such is caused by the strong ligaments, which tie down the ends of the two (separate) clavicles to the anterior end of the carina sterni.

The *interorbital septum* is not flattened down to a thin plate, which may even be here and there deficient; it is, on the contrary, of some thickness, though this is not so marked as in *Strix*. *Asio* and *Syrnium* are not, however, very far removed from *Photodilus* in this particular, though they are rather on the Bubonine than the Strigine side. The interorbital septum of *Photodilus* is, in fact, intermediate in its characters between that of *Strix* and that of *Syrnium*.

Fig. 1.



Photodilus badius: base of skull. Nat. size.

The *lateral ethmoid processes*, although not so swollen as in *Strix*, are not nearly so flattened as they are in *Bubo*, where they are thin plates hardly thicker than a piece of paper.

On the other hand, the general proportions of the skull are decidedly more like those of *Bubo* than of *Strix*.

The measurements are, length 63 millim., breadth 44 millim.

The *palatines*, though not so straight as in *Strix*, are less bowed than in *Bubo*, and there is not that sharply marked difference between their anterior and posterior regions that there is in the latter genus. In this particular also they approach *Strix*. Furthermore, in *Syrnium* and *Bubo* the postero-internal edge of the palatine is sharply bent down; this is hardly marked in *Strix* or *Photodilus*.

In comparing the skulls of *Strix* and *Bubo* the presence of two minute supraorbital bones in the latter is very noticeable; these are attached rather nearer to the anterior than to the posterior margin of the orbit. In *Strix*, where the configuration of the orbit from above is entirely different, the same bones, if present, are not conspicuous, but must be attached to supraorbital processes placed much further back.

Syrnium and *Photodilus* are midway between these two extremes.

As the skull of *Photodilus* studied by Milne-Edwards* was incomplete anteriorly, I have thought it worth while to introduce some figures (figs. 2, 2*a*, p. 297) into this paper illustrative of certain facts which cannot be shown properly, for the reasons stated, in Milne-Edwards's figures.

Milne-Edwards mentions particularly the absence in *Photodilus* of those occipital convexities which are so striking a feature in the skull of *Strix*; they are not, however, completely absent from the Bubonidæ, though, if present (as in *Nyctea*), they are very much less developed.

In *Syrnium*, as in *Photodilus*, they are completely absent.

The temporal fossæ, as Milne-Edwards has remarked, are deep, but they are not continuous with depressions appearing on the occipital region of the skull; it is rather important to direct attention to this character, because it seems to be diagnostic.

Strix flammea agrees with *Photodilus*, but in *Bubo, Asio, Speotyto, Nyctea, Ketupa*, and *Syrnium* there is a deepish fossa on each side of the head, which may be seen from behind to be a prolongation backwards of the temporal fossa. In this particular, therefore, the skull of *Photodilus* is like that of *Strix*, and unlike some genera, at any rate, of Bubonidæ.

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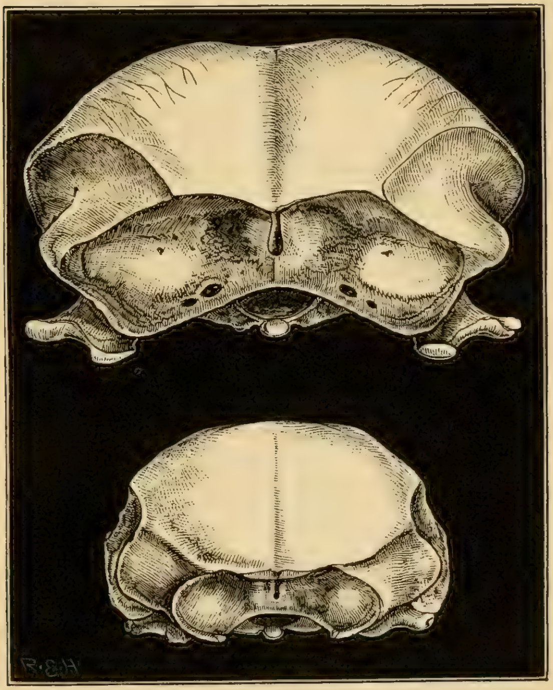
* "Observations sur les affinités zoologiques du genre *Photodilus*," etc., Nouv. Arch. Mus. 2e sér. t. i. (1878), p. 185.

In *Bubo* and *Syrnium* the maxillo-palatines are very large and conspicuous, and are but little concealed by the overlying palatines; in *Strix*, on the other hand, as I have pointed out, these bones are comparatively small and largely hidden by the palatines.

Figs. 2, 2 *a*.



The upper figure represents the posterior face of the skull of *Nyctea nivea*. The lower figure gives a corresponding view of the skull of *Photodilus badius*. Both are of the size of nature.

Photodilus is decidedly nearer to *Strix* in these points.

After describing the skull of *Photodilus*, Milne-Edwards says that "it is with the representatives of the group of *Syrnium*, not only in the conformation of the skull, but in many other points, that *Photodilus* presents the closest analogy." Prof. Newton *, however, is of opinion that it should not be definitely referred to the Bubonine group, but that it forms a connecting link between the Strigidæ and the Bubonidæ. This statement refers apparently to the osteological peculiarities of the skull and to the external characters of the genera; the latter are more Strigine, the former Bubonine.

I quite agree with Professor Newton, and also with M. Milne-Edwards, that *Syrnium* is the Bubonine type which comes nearest to *Photodilus*.

In my above-given account of the skull which supplements that of Milne-Edwards, attention is directed to many points in which *Photodilus* agrees now with *Syrnium* now with *Strix*.

It agrees with *Strix*:—

(1) In the absence of the extension over the occipital region of the temporal fossæ.
(2) In the comparatively narrow maxillo-palatines.
(3) In the approximately equal breadth throughout of the palatine.
(4) In the slightly swollen prefrontal processes of the ethmoid.
(5) In the comparative thicknesss of the interorbital septum.

It agrees with *Syrnium*:—

(1) In the general configuration and proportions between length and breadth.
(2) In the prominent forehead.
(3) In the absence of occipital convexities.

The *foot* of *Photodilus* (fig. 3, p. 299) offers certain peculiarities which distinguish it from that of all other Strigidæ which I have been able to study. At the same time, as regards the proportions of the first two phalanges of the third digit, it comes nearer to *Strix* than it does to *Bubo*; these two joints are not subequal, but the second is decidedly the longest. I take this opportunity of mentioning these points as it appears to me [*] that, although no doubt trifling, they are of some classificatory value from their constancy. Furthermore, as in Milne-Edwards's [†] illustration the toes are left unshaded and are not figured separately, it seems probable that his skeleton was so far defective.

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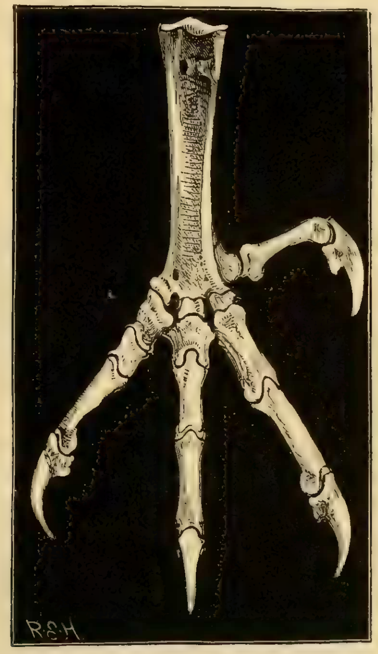
* Article "Owl," Encycl. Brit. xviii. p. 89.

Fig. 3.



Right foot of *Photodilus badius.* Nat. size.

The peculiarity in the bones of the feet of *Photodilus* concerns the three proximal phalanges of the fourth digit; the first two of these are fused, and the next following is of about half the size of the compound bone, thus showing that the size of the separate bones is equal, as in other Striges.

Ribs.—M. Milne-Edwards states (*op. cit.* p. 190) that " the

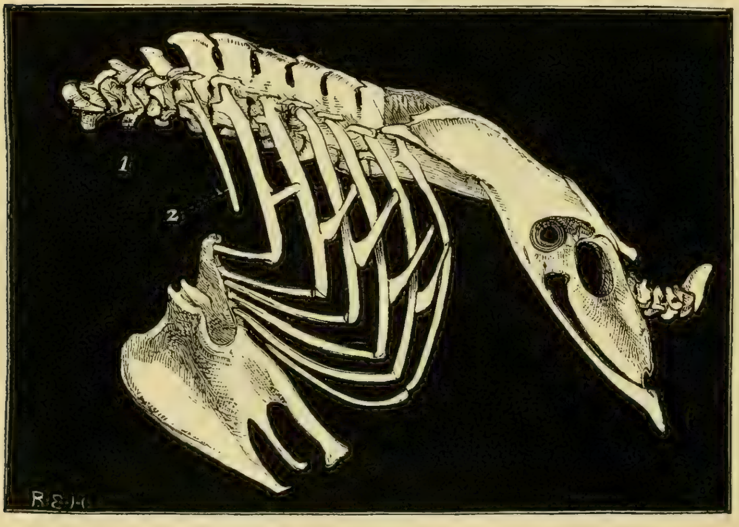
[*] *Cf.* Ibis, 1888, p. 339.

[†] Nouv. Arch. &c., *loc. cit.* pl. 4.

ribs are, as usual, seven pairs, but that five of them articulate directly with the sternum; the first pair alone are floating ribs, while in the little group of the Strigidæ two pairs thus remain in the condition of stylets; the second rib has no uncinate process, and the seventh, remarkable by its slenderness, is attached to the middle of the last sternal rib but one." These statements are entirely borne out by his figure (on plate 4) of the entire skeleton.

The skeleton which I have studied was evidently more carefully prepared than that which furnished the material for M. Milne-Edwards's admirable paper. In this specimen (see fig. 4) the seven ribs mentioned by Milne-Edwards are, of course, present; but, in addition, there is a small free rib (1) attached to the thirteenth vertebra on each side, about one eighth of the length of the next rib (2), and only furnished with one attachment to the transverse process. Moreover, the third (the first complete rib) on both sides of the body has perfectly well-developed uncinate processes, which are

Fig. 4.



Ribs, pelvis, and sternum of *Photodilus badius*: 1, first rudimentary (cervical) rib; 2, second do. Nat. size.

about half the length of those which follow and of a rather different shape. The second rib also appears to me to show a very faint trace of an uncinate process.

In *Strix flammea,* on the contrary, the first rudimentary rib, that on the thirteenth vertebra, although extremely short, has both a capitular and tubercular head; the uncinate processes appear to commence with the fourth rib; but I should not like to be positive about the latter point.

In both these types the upper extremity of the last rib is complete, and that of the penultimate rib is partially covered by the extension forwards of the ilium.

In *Bubo maximus* the third rib has uncinate processes, and there is (on one side) a minute trace of a *ninth* rib; the eighth rib is attached very nearly at the end of the seventh; the last two ribs are very completely covered at their vertebral attachment by the ilium.

In *Ketupa javanensis* both the twelfth and thirteenth vertebræ are furnished with rudimentary ribs, only attached to the transverse processes. It is possible that in this case as in others the main tubercular fragment is hardly ossified: the penultimate rib is hardly covered by the ilium. In other respects there are no differences from other Owls.

Of the *dorsal vertebræ* of *Photodilus* the last three have no hypapophysis. In this respect it agrees with *Strix;* but this fact appears to be of no moment in classification, for *Syrnium aluco, Bubo,* and *Athene noctua* have the same characters, while in *Ketupa javanensis* there are only *two* dorsal vertebræ thus unprovided with hypapophyses.

The *Pelvis.*—The conformation of this bone has been described by Milne-Edwards, who has figured it in two views; the following is his account of the bone (*op. cit.* p. 192):—"Le bassin est beaucoup plus raccourci que celui des Effraies, et par ce caractère il se rapproche un peu de celui des Chevèches, des Ciccaba et des Nyctales; les proportions relatives de la portion præcotyloïdienne et de la portion postcotyloïdienne sont à peu près les mêmes que chez ces oiseaux, tandis que chez les Otus les fosses iliaques sont notablement plus longues mais moins élargies. L'écusson pelvien est aplati comme

celui des Nyctales et les angles ischiatiques sont peu proéminents." There is another feature in the pelvis which seems, besides those mentioned by Milne-Edwards, to be of some importance. This is the pointed extremities of the ilia, which overlap the last ribs; these are perfectly well figured by Milne-Edwards.

These conditions are *exactly* repeated in *Strix*; but in *Ketupa* and *Syrnium* the antero-lateral processes of the innominates are much more blunt and altogether shorter in proportion.

VISCERAL ANATOMY.

The viscera, and in fact the soft parts generally, of *Photodilus* do not seem to have been ever studied.

The following notes may therefore not be without interest:—

The *liver-lobes* are unequal in size, the right being rather larger than the left. The liver-lobes are shut off by a delicate membrane from the subomental space, which appears to be formed by a fusion between the umbilical ligament and the oblique septa. I just mention this arrangement without for the present going any further into the matter, because the character appears to be one of classificatory importance.

I find, in fact, that in the Barn Owl there is no septum cutting off the liver in the way that has been described; but in *Asio otus* I find such an arrangement repeated.

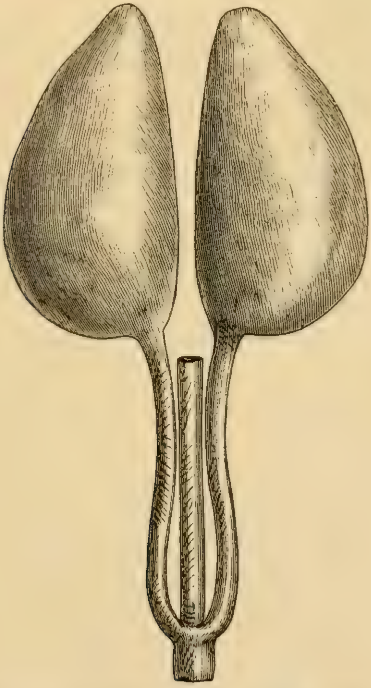
The *cæca* of *Photodilus* (fig. 5, p. 303) are, as in other Owls, swollen at their extremities; it seemed to me as if this swelling was more marked in *Photodilus* than in some other types of Owls.

The *gall-bladder* is large, and its duct enters the small intestines just at the top of the loop in front of the opening of the hepatic duct, which is itself considerably above the two pancreatic ducts; these latter are side by side, and placed about halfway up the distal side of the duodenal loop.

The *syrinx* is not very distinctive of the affinities of the bird. The last three tracheal and the first two bronchial rings are ossified; the intrinsic muscles, which are not strong, are attached to the second bronchial semiring (the last of the ossified rings).

The *tensores patagii* muscles are so far unlike those of *Strix* that there is no fibrous band uniting the extremity of the tendon of the *t. p. brevis* with the tendon of the *t. p. longus*. As I have already pointed out *, at least two species of *Strix* agree in possessing this fibrous band, which is probably characteristic of the genus.

Fig. 5.



Cæca of *Photodilus badius*. Twice the nat. size.

The foregoing description of the anatomy of *Photodilus badius* tends to support the conclusion that this Owl cannot be referred to the Strigine section, but that it must be included among the Bubonine genera. Among the latter *Syrnium* appears to be the form to which it is most closely allied. At the same time it is important to notice that it does present certain points of resemblance to *Strix*. These are not, however, in my opinion, sufficiently numerous or important to lead to the conclusion that *Photodilus* occupies a really intermediate position between the two families. The structure of *Photodilus* does not necessitate either the creation of a separate family for its reception, or the amalgamation of the two generally recognized families into one.

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* 'Ibis,' 1888, p. 341.

XXVII.—*On the Principal Modern Breeds of the Domestic Fowl*. By W. B. Tegetmeier, F.Z.S., M.B.O.U.

On the occasion of an exhibition of the various breeds of poultry in the grounds of the Zoological Society of London in September last, the Editor of 'The Ibis' did me the honour to suggest that an illustrated article on the subject of the modern varieties might be interesting to ornithologists, and requested me to undertake its production. I had much pleasure in acceding to his request. For many years I have been interested in the subject, not only from an anatomical, but also from a practical standpoint. My first introduction to Darwin was by Yarrell, thirty-five years ago, on which occasion the author of the 'Origin of Species,' which was not then published, came to my house to inspect a large collection of crania and other preparations illustrating the extent of variation in the domesticated *Gallus ferrugineus*. Engravings of several of these, and some figures of the heads of fowls of distinct breeds, were given in Darwin's 'Variation of Animals and Plants,' and it will be interesting to trace the extension of variation in the several breeds since the publication of that work in 1868 to the present time.

The breed which most closely resembles the wild *Gallus ferrugineus*, from which Darwin thought all the domestic varieties had descended, is (or, perhaps it would be more correct to say, was) the ordinary Game breed, one sub-variety of which, known as the Black-breasted Red Game, from the arrangement of colours in the male, differs from the wild original chiefly in being of larger size and in the more